

REMARKS

INTRODUCTION:

Claims 1, 3-5, 7, 9-12 and 14-17 are pending and under consideration.

REJECTIONS UNDER 35 U.S.C. §103:

The rejections all rely upon Lee. It was previously argued that Lee is not a proper reference under 35 U.S.C. §103(c)(1). Specifically, it was argued that Lee and the present application have a common assignee and Lee only qualifies as a reference under 35 U.S.C. §102(e)(2).

In response to these arguments, the Examiner relies upon U.S. Publication 2003/0039493 (the pre-grant publication of Lee) as the basis of a rejection under 35 U.S.C. §102(a). The publication date of this reference is February 27, 2003, whereas the priority filing date of the present application (based on Korean Application 2002-43888) is July 25, 2002. A verified translation of KR 2002-43888 is submitted herewith. Since this verified translation supports a date of invention prior to the publication date of Lee, Lee may not be relied upon as the basis of a rejection under 35 U.S.C. §102(a).

Accordingly, withdrawal of the rejections is requested.

CONCLUSION:

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.


Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 8-5-05

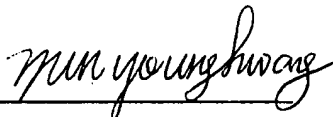
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DECLARATION

I, Yun-young Hwang, a Korean citizen of 8th floor, Daelim Bldg., 1600-3, Seocho-dong, Seocho-gu, Seoul, Korea, do hereby solemnly and sincerely declare as follows:

1. That I am well acquainted with the English and Korean languages.
2. That the following is a correct translation into English of the accompanying certified copy of a Korean Patent Application No. 2002-43888, and I make the solemn declaration conscientiously believing the same to be true.

A handwritten signature in cursive script, reading "yun young hwang", written in black ink.

Yun-young Hwang

July 25, 2005

Seoul, Korea



KOREAN INTELLECTUAL PROPERTY OFFICE

5 This is to certify that the following application annexed hereto is a true copy from
the records of the Korean Intellectual Property Office.

Application Number: Patent Application No. 2002-43888

10 Date of Application: July 25, 2002

Applicant(s): Samsung Electronics Co., Ltd.

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Dated on September 23, 2002

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COMMISSIONER

[DOCUMENT] Application for patent

[CATEGORY OF RIGHTS] Patent

[RECEIVING PERSON] The commissioner of the Korean Intellectual Property Office

[DATE OF FILING] 2002.07.25

[TITLE OF THE INVENTION-KOREAN] 화상형성장치의 정착기

[TITLE OF THE INVENTION-ENGLISH] Image fixing device of image forming apparatus

[APPLICANT]

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[APPLICANT CODE] 1-1998-104271-3

[EMPOWERED ATTORNEY]

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[ATTORNEY CODE] 9-1998-000543-3

[REGISTRATION NUMBER OF GENERAL POWER OF ATTORNEY]

2000-046970-1

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[ZIP CODE] 442-727

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[REQUEST FOR EXAMINATION] Requested

[PURPOSE] I, hereby, submit the present application for the Patent under the Article 42 and
request Examination under the Article 60 of the Patent Law.

Agent Hong-sik JEONG (seal affixed)

[Official Fee]

[Basic fee] 12 pages 29,000 won

[Additional fee] 0 page 0 won

[Claiming Priority Right] 0 case 0 won

[Filing Request For Examination]	4 claims	237,000 won
[Total]		266,000 won
[ATTACHMENT]	1. One copy of Abstract/Specification (Drawing)	

[ABSTRACT]

[Abstract of the disclosure]

An image fixing device of an image forming apparatus is disclosed. The image fixing device includes a pressure roller and a heating roller to rotate as if it is in contact with the pressure roller, with a paper fed therebetween, to fix a developed image to the paper by applying heat generated by a heating member installed inside therein. The heating roller is a heat pipe of a closed tube type. The heat pipe of the closed tube type has a fluid poured inside of a closed space thereof. The heating member is an induction heating body to generate a magnetic field to the heating roller. The heat generated by induction heating is applied to the heating roller including the heat pipe to keep a temperature around the surface thereof at a predetermined uniform level.

[Main Figure]

FIG. 2

[Search Terms]

heat pipe, fixing device, heating roller, pressure roller, induction heating

[SPECIFICATION]

[The title of the invention]

Image fixing device of image forming apparatus

[The brief description of the drawings]

FIG. 1 is a diagram showing a conventional image forming apparatus employing an image fixing device; and

FIG. 2 is a schematic diagram showing an image forming apparatus having an image fixing device according to an embodiment of the present invention.

<Description of the reference numerals in the drawing>

200	image forming apparatus	260	fixing device
262	heating roller	262a	outer conductor
262b	closed space	262c	inner conductor
264	induction heating coil	266	temperature sensor
268	pressure roller	270	power supplying unit
280	engine control unit		

[Detailed description of the invention]

[Object of the invention]

[The field of the invention and the prior art]

The present invention relates to an image fixing device of an image forming apparatus, and more particularly, to an image fixing device of an image forming apparatus implementing a heating roller to apply heat to an image developed on a printing paper to fix the developed image by using a heat pipe.

Generally, a copy machine, a printer, a facsimile, and a combination of these machines or the like all perform a printing function and are generally referred to as image forming apparatuses.

The image forming apparatus forms an electro-static latent image by exposing image data fed from an outside to a photoconductor, develops the formed electro-static latent image using a developing agent, and transfers the developed image onto a printing paper. The image forming apparatus fixes the transformed image to the printing paper by using an image fixing device thereof, and discharges the printed paper.

This kind of image fixing device fixes an image to the printing paper by applying

heat and pressure to the paper with an image formed thereon.

FIG. 1 is a diagram showing a part of a conventional image forming apparatus employing an image fixing device.

Referring to FIG. 1, the conventional image forming apparatus 100 includes an image fixing device 110, an electric power supplier 120 and an engine controller 130. The image fixing device 110 includes a heating roller 112 and a pressure roller 114.

The heating roller 112 has a multiple layer structure of 2 or 3 layers, and applies heat to a printing paper having an image formed thereon (shown in a thick solid line) to fix the image to the paper. The heating roller 112 is equipped with an internally installed induction heating coil 112a. The induction heating coil 112a generates a magnetic field by an AC electric power supplied by the electric power supplier 120.

The magnetic field generated by the induction heating coil 112a generates induced current on the inner surface of the heating roller 112, thereby generating a Joule's Heat. The heating roller 112 is equipped with an externally installed thermistor 112b to detect a temperature of the heating roller 112 heated by the induction heating coil 112a.

The engine controller 130 controls an electric power supply to the heating roller 112 in response to the temperature detected by the thermistor 112b.

The pressure roller 114 rotates as if it is in contact with the heating roller 112 to apply a pressure to the printing paper with the image transferred thereto, thereby fixing the image to the paper. The heating roller 112 and the pressure roller 114 rotate respectively in the arrowed directions as shown in FIG. 1, to discharge the printed paper.

However, the conventional heating roller 112 has a difference in temperature between both ends and a center thereof, and the difference in temperature reduces fusing efficiency. AC magnetic fields occurring around the ends and the center differ from each other, thereby deteriorating the fusing efficiency of the image.

As a result, the conventional heating roller 112 lacks a uniformity of temperature along the longitudinal direction thereof, while having a uniform temperature in the circumferential direction.

[Technical object of the invention]

Accordingly, it is an aspect of the present invention to provide an image fixing device capable of keeping a temperature around the surface of a heating roller uniform to fix a developed image on a paper.

5 **[Construction and operation of the invention]**

The foregoing and/or other aspects and advantages are realized by providing a pressure roller; a heating member; and a heating roller, the heating member being installed therein, to rotate with the pressure roller to fix a developed image to a fed paper by applying heat generated by the heating member, wherein the heating roller is a heat pipe of a closed
10 tube type.

The heat pipe of the closed tube type may have a fluid poured inside of a closed space thereof.

The heating member may be an induction heating body to generate a magnetic field to the heating roller and the heating roller may be installed to rotate separately from the
15 heating member.

Hereinbelow, the present invention will now be described in greater detail with reference to the accompanying drawings..

FIG. 2 is a schematic diagram showing an image forming apparatus having an image fixing device according to an embodiment of the present invention.

20 Referring to FIG. 2, the image forming apparatus 200 includes a charging roller 210 as a first roller, a photoconductor 220, a LSU ("Laser Scanning Unit") 230, a developing unit 240, a transferring roller 250 as a second roller, an image fixing device 260, a power supplying unit 270 and an engine control unit 280.

25 A high voltage is applied to the charging roller 210 to uniformly charge the surface of the photoconductor 220, which rotates in contact with the charging roller 210. As the LSU 230 emits the laser, an electro-static latent image is formed on the surface of the photoconductor 220. The developing unit 240 provides the electro-static latent image formed on the surface of the photoconductor 220 with a toner to develop the image.

The developed image on the photoconductor 220 is transferred to the printing paper

as a recording medium by the potential difference between the photoconductor 220 and the transferring roller 250. The image fixing device 260 fixes the transferred image to the paper by applying a predetermined heat and pressure.

The image fixing device 260 includes a heating roller 262 and a pressure roller 268.

5 The heating roller 262 applies heat to the paper, thereby fixing the transferred image to the paper. The heating roller 262 may be a heat pipe of a closed tube type having a hollow. The closed tube type heat pipe is a heat transmission device to propagate/circulate a large amount of heat even with a minor temperature difference by using a latent heat of an evaporating fluid.

10 The heating roller 262 of the closed tube type heat pipe includes an outer conductor 262a, a closed space 262b and an inner conductor 262c.

The closed space 262b formed between the outer conductor 262a and the inner conductor 262c, is vacuous. A working fluid is poured into the closed space 262b. The working fluid may use a substance capable of a phase change, according to a temperature change, such as distilled water.

15 Inside of the heating roller 262, i.e., in the closed space 262c of the heating roller 262, is disposed an induction heating coil 264 which is applied as a heating member. The heating member is an induction heating body generating a magnetic field to the heating roller 262. The induction heating coil 264 is coiled around a magnetic core (not shown).

20 The heating roller 262 is installed to rotate separately from the induction heating coil 264. For example, the induction heating coil 264 may be stationary while the heating roller 262 rotates. Alternately, the heating roller 262 and the induction heating coil 264 may be installed to rotate in different directions.

25 The power supplying unit 270 supplies an AC power of tens to hundreds of kHz to the induction heating coil 264, thereby generating an AC magnetic field around the induction heating coil 264. The generated magnetic field causes the inner conductor 262c of the heating roller 262 to generate heat.

The inner conductor 262c may be made of a material which is capable of generating heat in response to a change of the magnetic field.

An eddy current is generated on the surface of the inner conductor 262c of the heating roller 262 by the AC magnetic field which is generated by the induction heating coil 264, and, in turn, a Joule's heat is generated by an eddy current loss generated on the surface of the inner conductor 262c.

5 The Joule's heat generated by induction heating evaporates the fluid in the closed space 262b. The evaporated fluid circulates in the closed space 262b of the heating roller 262 to transfer the heat so that the temperature of the outer conductor 262a can reach a temperature necessary for fixing in a short period of time.

10 This kind of induction heating may shorten or eliminate a warm-up time for printing which is necessary for an initial operation of the image forming apparatus 200. Thus, the power supplying unit 270 does not need to supply an electric power to the image forming apparatus 200 until a print or copy command is applied thereto, but only needs to maintain a low power supply of less than 10 watts for warm-up.

15 A continuous circulation of the fluid keeps the temperature of the surface of the outer conductor 262a at a predetermined uniform temperature. Namely, the heating roller 262 has a uniform temperature distribution along a longitudinal direction as well as a circumferential direction thereof, and maintains a predetermined temperature or a range of the temperature. This enables a uniform fixation of the developing agent to the paper.

20 On the surface of the outer conductor 262a of the heating roller 262, a temperature sensor 266 is installed to detect the temperature of the heating roller 262 heated by the induction heating coil 264. The temperature sensor 266 may be a thermistor.

25 The engine control unit 280 controls the power supplying unit 270 in response to the temperature detected by the temperature sensor 266. Specifically, the power supplying unit 270 regulates an amount of AC power to be supplied to the heating roller 262 under the control of the engine control unit 280.

30 The pressure roller 268 rotates as if it is in contact with the heating roller 262 to apply pressure to the paper with the image transferred thereto, thereby fixing the transferred image to the paper. The heating roller 262 and the pressure roller 268 rotate respectively in the directions indicated by the arrows, to discharge the image-fixed paper in the direction indicated by the arrows.

The paper discharged from the image fixing device 260 is outputted through a discharge port (not shown) of the image forming apparatus 200.

[Effect of the present invention]

5 The image forming apparatus in accordance with the present invention provides an image fixing device capable of keeping a temperature around the surface of the heating roller at the predetermined uniform temperature or at the predetermined range of uniform temperature. This is because the heating roller including the heat pipe generates the Joule's heat from the eddy currents by the magnetic field which is generated by the induction heating coil.

10 Since a warm-up time for printing which is necessary for an initial operation of the image forming apparatus is shortened due to the induction heating generated by the coil, a power consumption of the image fixing device is reduced.

15 Although an embodiment of the present invention has been shown and described, it will be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

WHAT IS CLAIMED IS:

20 1. In an image fixing device of an image forming apparatus comprising: a pressure roller; a heating member; and a heating roller, the heating member being installed therein, to rotate with the pressure roller to fix a developed image to a fed paper by applying heat generated by the heating member, the image fixing device characterized in that the heating roller is a heat pipe of a closed tube type.

25 2. The image fixing device according to claim 1, characterized in that the heat pipe of the closed tube type forms a closed space therein and has a fluid inside of the closed space.

30 3. The image fixing device according to claim 1, characterized in that the heating member is an induction heating body to generate a magnetic field in the heating roller.

4. The image fixing device according to claim 1, characterized in that the heating

roller rotates separately from the heating member.